receiver filter functions 360 comprises output signals $a^{*(i)}(n)$ and $a^{*(j)}(n)$. These output signals may be switched at a rate of $1/T$ to produce corresponding signals $\hat{a}$ to $i(n)$ and $\hat{a}$ to $j(n)$.

5   Since $H(f)$ is unknown, direct computation of $P(f)$ is not feasible, since the matrix $P(f)$ depends on the impairment matrix $H(f)$. However, $\boldsymbol{P}(f)$ is found based on iterative methods according to an embodiment of the invention. By starting with $\tilde{\boldsymbol{P}}(f)$ in place of $\boldsymbol{P}(f)$ and $\tilde{\boldsymbol{P}}(f)$ until the mean-square-error at the slicer of receiver 108 is minimized, then $\tilde{\boldsymbol{P}}(f)$ is a reasonable first approximation of $\boldsymbol{P}(f)$. $H(f)$ cannot necessarily be predicted accurately. A

10   predetermined CAP signal has to be transmitted and the received CAP signal can be measured to determine errors in the received CAP signal.

Illustratively, for channel i, the transmitted CAP signal $a^{(i)}(n)$, after propagating through the channel, is sampled as $a^{*(i)}(n)$ at the receiver. The difference between the transmitted CAP signal and the received CAP signal is

15   the difference error. The CAP signal for signal j causes interchannel interference with channel i. If the error is caused by the interference from channel j, through the cross-talk transfer function $H_{ij}(f)$ (i.e., 345$_j$), this error information can be used to adjust the pre-coder $P_{ij}(f)$, (i.e., 310$_j$).

The two shaded paths in Figure 3 illustrate interchannel interference. In

20   the first shaded path, transmit signal $a^{(j)}(n)$ propagates through channel j by a path comprising summer function 320$_j$, transmit filter function 330$_j$, second channel impairment function 345$_j$ and data slicer function 350$_i$. At second summer function 350$_i$, the two CAP signal symbol streams are commingled and received via receiver function 360$_i$

25   The difference between the expected signal shape and level and the actual received signal shape and level is determined. In a second shaded path, a pre-coded CAP signal provided by pre-coder function 310$_j$ is propagated through a path comprising summer 320$_i$, transmit filter function 330$_i$, and first channel I impairment function 340$_i$ (i.e., $H_{ii}(f)$) and to second I

30   channel summer function 350$_i$.

FIG. 3 shows that the effect of pre-coding transfer function $P_{ij}(f)$ (310i) is to cancel the effect due to the cross-talk transfer function $H_{ij}(f)$ (345$_j$). The sum of the two paths should be zero. Specifically, P_{ij} is adjusted so that the difference between the two signals become zero. That is the two paths should

5   have the opposite transfer function resulting in a sum of zero. Hardware and/or software suitable for realizing the pre-coder function may be implemented using techniques similar to those used for implementing an adaptive canceler.

FIG. 4 depicts a high level block diagram of a multiple channel

10   transmission system according to an embodiment of the present invention. It will be appreciated by those skilled in the art that while the system 400 of FIG. 4 is depicted as including four encoding, transmitting and receiving entities, more or fewer encoding, transmitting and/or receiving entities may be utilized.

Each of the four transmitters depicted in FIG. 4 (denoted as channels A

15   through D) comprises an encoder E that receives a respective bitstream or data signal or DS to be transmitted. The output of each encoder E, illustratively a CAP symbol stream of the form $a^{(x)}(n)$, where x identifies the particular channel, is coupled to a corresponding summer S and to the input of a pre-coder function within each of the other channels.

20   Each of three pre-coder functions (one for every other channel to be processed) used in each channel is used to adapt the encoded symbol stream to a respective one of the three remaining channels. The pre-coder functions are denoted as $P_{xy}(f)$, where x denotes the channel that utilizes the output of the pre-coder function, and y denotes the channel providing input to

25   the pre-coder function. Thus, for example, pre-coder $P_{12}(f)$ receives input from the encoder E_2 of the second channel (i.e., channel B) and provides output to the summer S_1 of the first channel (i.e., channel A).

Each summer S receives the output of its respective encoder E, as well as the output of a respective pre-encoder function ($P_{12}(f)$, $P_{13}(f)$ and $P_{14}(f)$ in the

30   case of channel A) from each of the three other transmission channels. The summer S sums the received signals to produce an output signal of the form

$v^{(i)}(n)$, which is coupled to a transmit filter function $G(f)$. The output of transmit filter function $G(f)$ is propagated to a respective receiver via a respective communications channel.

Referring to channel A in the system 400 of FIG. 4, the transmitter

5 includes an encoder E_1 that produces an encoded symbol stream of the form $a^{(1)}(n)$ in response to a received data signal DS_1. The encoded symbol stream is provided to a summer S_1. The summer S_1 also receives three other signals provided by respective pre-coders. A first pre-coder $P_{12}(f)$ receives an encoded signal $a^{(2)}(n)$ produced by an encoder E_2 of the second transmitter.

10 Similarly, the second $P_{13}(f)$ and third $P_{14}(f)$ pre-coders receive encoded signals from the third E_3 and fourth $E4$ transmitters. Each of the pre-coders $P_{12}(f)$ through $P_{14}(f)$ provides a respective pre-coded output signal $u^{(12)}(n)$ through $u^{(14)}(n)$ to the summer S_1. The summer S_1 sums the encoded signal produced by the encoder E_1 and the signals produced by the three pre-coders

15 to produce an output signal $v^{(1)(n)}$ that is coupled to the first transmitter filter $G_1(f)$. The output of the transmitter filter $G_1(f)$ is transmitted by a respective channel to a corresponding receiver $R_1(f)$.

The transmission channels are depicted as having various channel impairments $H(f)$. Specifically, a transmission channel impairment $H_{11}(f)$

20 operates upon data transmitted via the first transmission channel. Similarly, a second channel impairment $H_{12}(f)$ represents the impairment to data within the first transmission channel caused by interference or cross-talk from the second transmission channel. A third impairment channel $H_{13}(f)$ represents the impairment to data within the first transmission channel caused by

25 interference or cross-talk from the third transmission channel. A fourth impairment $H_{14}(f)$ represents the impairment to data within the first transmission channel caused by cross-talk or interference from the fourth transmission channel.

Each of the channel impairments $H_{11}(f)$ through $H_{14}(f)$ are depicted as

30 being summed by a summer SH_1. It is noted that such summation does not actually exist as a discrete element; rather, the summation function SH_1